

WHAT IS CLAIMED IS:

1. In a superjunction semiconductor device; a semiconductor body region of a first conductivity type and having parallel top and bottom surfaces; a plurality of spaced pylons of the other conductivity type extending through at least a portion of the thickness of said body region; a respective MOSgated structure including a source region disposed in a channel region which is positioned above and in contact with each of said pylons, the major length of said pylons extending from their ends which are closest to said bottom surface being in charge balance with the body region surrounding them; the remaining length of each of said pylons at the top thereof having a higher concentration than that of said major length whereby avalanche current is at least partly directed toward the center of the top of said pylon and away from the R_b region in said channel and beneath said source.

5 2. The device of claim 1 wherein said charge in said remaining length is up to about 20% greater than that in said major length of said pylon.

10 3. The device of claim 1 wherein said remaining length of said pylons is less than about 25% of the length of said pylon.

4. The device of claim 2 wherein said remaining length of said pylons is less than about 25% of the length of said pylon.

5 5. A P type semiconductor pylon in an N type body for a superjunction device; said P type pylon having an increased concentration at its top end which is greater than and overbalances the concentration of the surrounding N type body; the remainder of the length of said pylon being in charge balance with the surrounding N type body.

6. The device of claim 5 wherein said charge in said remaining length is up to about 20% greater than that in said major length.

7. The device of claim 5 wherein said remaining length of said pylons is less than about 25% of the length of said pylon.

8. The device of claim 6 wherein said remaining length of said pylons is less than about 25% of the length of said pylon.

5

9. A superjunction device having improved avalanche capability; said device comprising a semiconductor wafer body of one conductivity type and having a major electrode on the bottom of said wafer; a plurality of identical and spaced pylons of the other conductivity type extending through at least a portion of the thickness of said wafer; at least the lower portions of said pylons being in charge balance with said wafer body; and a portion of the top of said pylons having a greater charge than that of said lower portions.

10. The device of claim 9 wherein the charge in said top of said pylons is about at least 15 to 20% greater than that of said lower portions.

11. The device of claim 9 wherein the length of said portion of said top is less than about 25% of the full length of said pylons.

12. The device of claim 10 wherein the length of said portion of said top is less than about 25% of the full length of said pylons.

13. The device of claim 9 which further includes MOSgated structures disposed at the top of each of said pylons; said MOSgated structure comprising a channel region of said opposite conductivity type and which extends across and overlaps its respective pylon; a respective source region of said one conductivity extending into each of each channel regions and defining R_b regions in said channels and beneath said sources which are removed from the outer periphery of said pylon top; a gate structure extending across respective invertible channel regions between

said source and channel regions at the top of said wafer; and a source electrode extending over the top of said wafer and in contact with each of said source and channel regions.

14. The device of claim 13 wherein the charge in said top of said pylons is about at least 15 to 20% greater than that of said lower portions.

15. The device of claim 13 wherein the length of said portion of said top is less than about 25% of the full length of said pylons.

16. The device of claim 14 wherein the length of said portion of said top is less than about 25% of the full length of said pylons.